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Geology and Localities of Monkey Fossils in the La Venta Badlands, Colombia, South America

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INTRODUCTION

Along the Magdalena River flowing northward between Central and Eastern Cordillera in Colombia, Neogene continental sediments are widely exposed (VAN HOUTEN & TRAVIS, 1968). At the northeastern side of Villavieja, a small village on the east side of the middle part of the Magdalena River, Middle Miocene Honda Group is extensively developed. This area is very famous for the occurrence of vertebrate fossils including monkey fossils and STIRTON called these fossil assemblages as the La Venta fauna (STIRTON, 1951).

Since 1977, the paleontological survey has been carried out, jointly organized by Primate Research Institute of Kyoto University, JAPAN and INGEOMINAS, Colombia, and lots of new materials of monkey fossils have been discovered there. In this paper the geology of the surveyed area and the localities of monkey fossils are reported.

STRATIGRAPHY

The Honda Group exposing in the surveyed area is tentatively divided into the following six units on the basis of the subdivision of FIELDS (1959).

	Thickness
Las Mesitas Sands and Clays	(15+)
Upper Red Bed (= UR)	42
Unit between UR and LR	28
Lower Red Bed (= LR)	8
“Monkey Unit”	58
Cerbatana Gravels and Clays	(38+) (meters)

As FIELDS described, these units are informal subdivision for convenience to clarify the stratigraphic sequence of the fossil assemblages herein.

Cerbatana Gravels and Clays

This unit is composed of pebble to cobble conglomerates and coarse, cross-laminated sandstone beds, partially interbedded with thin siltstone beds. The upper part contains rich gravels and on the weathered surfaces the black torpedo-shaped concretions are often observed. The concretionary sandstone beds form the characteristic badland cliffs. The interbedded claystone beds are usually very thin or lenticular and sometimes contain some vertebrate fossils.

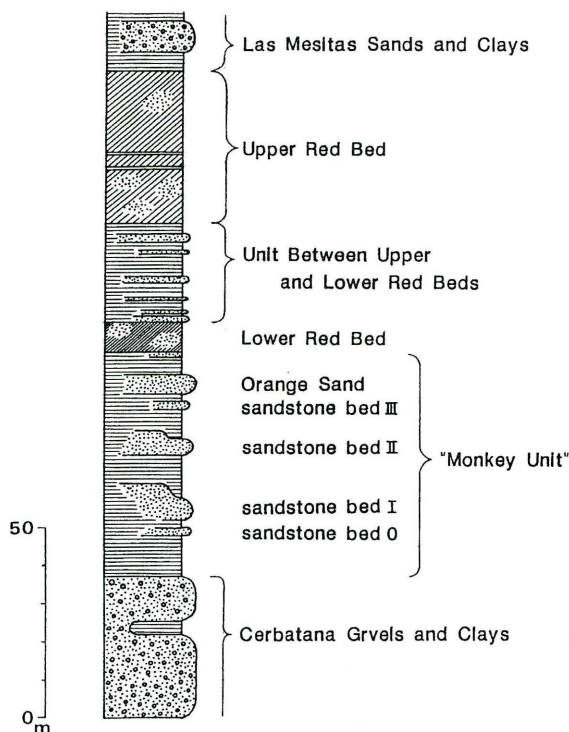


Fig. 1. Summarized columnar section of the La Venta badlands

"Monkey Unit"

This new unit includes six units as defined by FIELDS, namely, in ascending order, Monkey Unit, Unit below Fish Bed, Fish Bed, Unit above Fish Bed, Ferruginous Sands, and Unit between Ferruginous Sands and Lower Red Bed, and is composed of alternations of sandstone and siltstone beds. Within this unit four or five thick sandstone beds are observed, but they are very variable in thickness. Some of them lithologically change laterally to siltstones drastically or are divided into two thin sandstone beds partially interbedded by siltstone beds. Locally gravel layers are observed in the thick sandstone beds, and black torpedo-shaped concretions are often formed on the weathered surfaces of them.

The colors of the siltstone beds are various and easily variable; reddish brown, brown, orange, yellowish brown, grey, bluish grey, green, etc. The reason why these colors appear is not known, and such colors cannot be utilized to distinguish the siltstones. These siltstone beds richly contain vertebrate fossils. By the screening and washing methods, lots of isolated teeth have been discovered from the siltstone lens in the lower part of this unit (SETOGUCHI et al., 1983; 1984, 1986; 1988). Type specimens of *Cebupithecia sarmientoi*, UCMP 38762, and *Neosaimiri fieldsi*, UCMP 39205, were probably discovered from the almost same horizon, and some isolated teeth of *Stirtonia*, UCMP 39204 & 39206, were found from the upper part of this unit (STIRTON, 1951; FIELDS, 1959).

Lower Red Bed

This unit is named after its characteristic red color. It is composed of brick-red mudstone with orange colored fine-grained sandstone lenses. This red bed can be easily identified as the useful key bed, and, to be surprised enough, contains no vertebrate fossils.

Unit between UR and LR

This unit is composed of frequent alternations of sandstone, siltstone and claystone beds. Each sandstone bed is not so thick but often forms small lenses or tongues. The interbedded siltstone and claystone beds show various kinds of colors, and richly contain vertebrate fossils.

Upper Red Bed

This thick red mudstone beds form the famous Tatacoa desert. Although most parts of this unit are composed of red mudstone, a thick sandstone bed and some thin layers of white claystone are interbedded. This sandstone bed is so tough to erosion that it usually forms a kind of sandstone platforms. The white claystone layers are not so continuous laterally but appear at several places at the lower part of this unit. In 1988, one almost complete lower jaw of ceboid monkey was discovered from this horizon (SETOGUCHI et al., in this volume), and the second specimen of *Neosaimiri* was discovered just below the same point in 1989.

The color of the mudstone is basically red or dull-red, but sometimes yellow or grey bands are observed. The lowest part changes its color from red to yellow or yellowish brown and then becomes grey siltstone. At the uppermost part, a thick grey band is observed.

Las Mesitas Sands and Clays

Enough investigation has not been carried out as yet for this unit. It is mainly composed of thick sandstone and brown to grey siltstone beds. The sandstone richly contains small to medium sized gravels, and black concretions are observed on the weathered surfaces.

COMPARISON TO THE STRATIGRAPHIC UNITS DEFINED BY FIELDS

Geology of the La Venta badlands was precisely described by FIELDS (1959). He subdivided the Honda Group exposing there into twelve informal units.

FIELDS (1959) (thickness; meters)	This Paper
Las Mesitas Sands and Clays	Las Mesitas Sands and Clays
Upper Red Bed (= UR) (70.0)	Upper Red Bed (42)
Unit between UR and LR (45.0)	Unit between UR and LR (28)
Lower Red Bed (= LR) (14.5)	Lower Red bed (8)
Unit between Ferruginous Sands and Lower Red Bed (35.5)	
Ferruginous Sands (13.0)	
Unit above Fish Bed (10.0)	"Monkey Unit" (58)
Fish Bed (3.0)	(Including San Nicolas Clays)
Unit below Fish Bed (21.5)	
Monkey Unit (35.5)	
Cerbatana Gravels and Clays (238.5)	Cerbatana Gravels and Sands
(Including San Nicolas Clays)	
El Libano Sands and Clays	

His subdivision should be correlated with the occurrence of fossils, so it is too minute and local to trace wide area laterally. For example, the Fish bed, recognized as a marker-bed by FIELDS, greatly varies in thickness and color; in the eastern part of this area, it is quite thick and characteristically observed, but to the western, it is extinguished or divided into several thin beds. The Ferruginous Sands Unit is also useless as a key bed by the same reasons. So in this paper, some of his units are combined together into one unit, "Monkey Unit".

On the other hand, FIELDS interpreted the San Nicolas Clays as the upper part of the Cerbatana Gravels and Clays. However, in our interpretation, the San Nicolas Clays must be equivalent to the lowest part of "Monkey Unit", because the beds trend toward nearly NS and dip gently to the west, and the San Nicolas Clays Unit obviously overlies the Cerbatana Gravels and Clays. Although FIELDS estimated all the units very thick, our observation concluded that his methods resulted in over-estimation.

TAKEMURA also reported the geology of the La Venta badlands and compared his conclusion with the stratigraphic units of FIELDS (TAKEMURA, 1983). The correlation between them is not so sufficient enough for comparison, because TAKEMURA did not recognize some units of FIELDS at the surveyed area.

GEOLOGICAL STRUCTURE, AND LOCALITIES OF MONKEY FOSSILS

In this paper the surveyed area is subdivided into three parts; El Dinde area (north of the Quebrada Cerbatana), La Venta area (between the Quebrada Cerbatana and the Quebrada La Venta), and El Cusco area (south of the Quebrada La Venta). Although these three areas, of course, are not strictly discriminated but continuous to one another, it is convenient to describe the geological structure and the localities of monkey fossils.

In El Dinde area, the beds generally show NS to N20°E in strike and 3 to 6°W in dip. At the southwestern half of this area, the Cerbatana Gravels and Clays are widely developed. At the other half of this area, the colorful siltstone beds are exposed with thick lenticular sandstone beds on it. This siltstone was called the San Nicolas Clays and interpreted as one of lenses within the Cerbatana Gravels and Clays by FIELDS, probably because he interpreted the sandstone bed overlying the San Nicolas Clays as the Cerbatana Gravels and Clays. Although this sandstone bed certainly contains rich gravels locally, it does not continue to the Cerbatana Gravels and Clays. The San Nicolas Clays obviously overlies the Cerbatana Gravels and Clays, and must be included in the part of the "Monkey Unit".

A small hinge fault (EW direction displaced downward on the south side), southeast of the small house called the casa de El Dinde, makes the structure of this area a little complicated. Its maximum displacement is about 10 meters. A small synclinal structure is observed about 500 meters southwest of this hinge fault. These two structures have been already described by FIELDS. About 250 meters south of this syncline, another small but very important fault was newly discovered. The direction of this fault is N68°E and the north side is displaced downward by two or three meters, and interestingly enough at the southern area of this fault the beds strike toward about N60°W and dip to 4–5°S. FIELDS also paid attention to the differences of the strikes between the El Dinde area and the La Venta area, and interpreted that there must be an anticlinal structure with the axis of NE-SW direction. However, the existence of this fault may deny such structure as anticline in this area. The San Nicolas Clays, now a part of the "Monkey Unit" of El Dinde area, contain rich vertebrate fossils, especially some monkey fossils; *Stirtonia tatacoensis*,

UCMP 38989, *Aotus dindensis*, IGM-KU-8601, and the second specimen of *Cebupithecia sarmientoi*, IGM-KU-8602.

In the La Venta area, the Cerbatana Gravels and Clays are exposed in its northern part, and the "Monkey Unit" is developed in the southern part. The beds strike toward about N60°W and dip to 4–5°S. At the top of the Mesas, table-lands, the Mesa Conglomerate unconformably overlying the "Monkey Unit" is exposed. As already mentioned above, from the "Monkey Unit" of this area so many monkey fossils have been discovered; *Cebupithecia sarmientoi*, UCMP 38762, *Neosaimiri fieldsi*, UCMP 39205, *Stirtonia tatacoensis*, IGM-KU-III-1, *Kondous laventicus*, IGM-KU-8201 & 8202, *Micodon kiotensis*, IGM-KU-8401, all these from the lower part of the "Monkey Unit"; and from the upper part, the Fish Bed, two isolated teeth were discovered as a species of *Stirtonia*, UCMP 39204 & 39206.

In the El Cusco area, the beds strike toward N80°W–EW and dip to 3–5°S. The Lower Red Bed is exposed at the northern sides of hills along the Quebrada La Venta, and at the southern basin, which is well known as the Tatacoa desert, the Upper Red Bed is widely exposed. From the lowest part of the Upper Red Bed, as mentioned above, two new materials of monkey fossils were discovered in 1988 and 1989 field seasons; one is a new genus closely related to *Neosaimiri* or living squirrel monkeys, *Saimiri*, found in 1988, and the other is the second specimen of *Neosaimiri*, found in 1989. Near this area, some small faults (EW direction usually displaced downward on the south side) are observed.

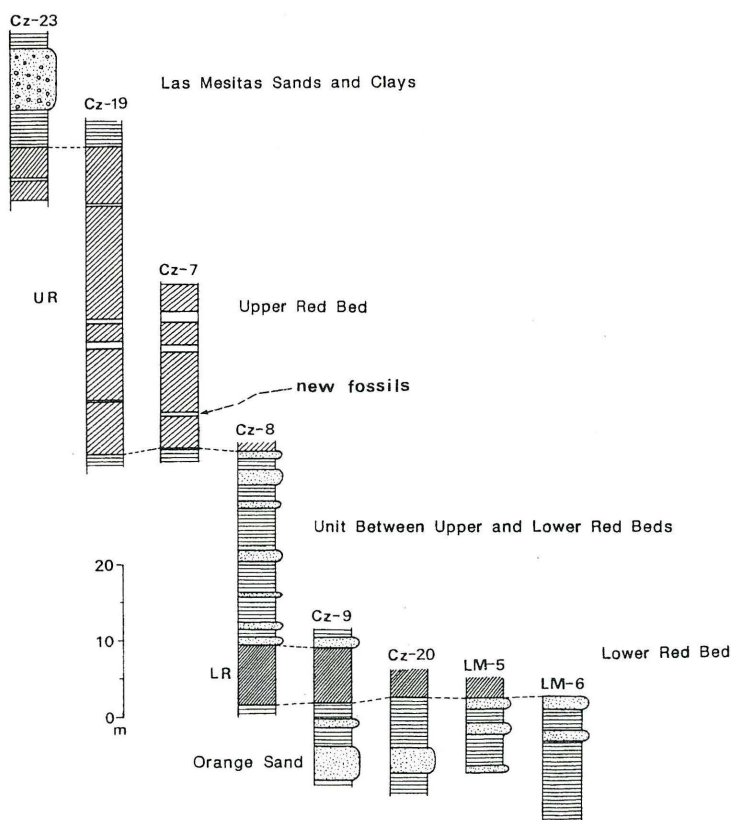


Fig. 2. Columnar sections (see also Figs. 3 and 4)

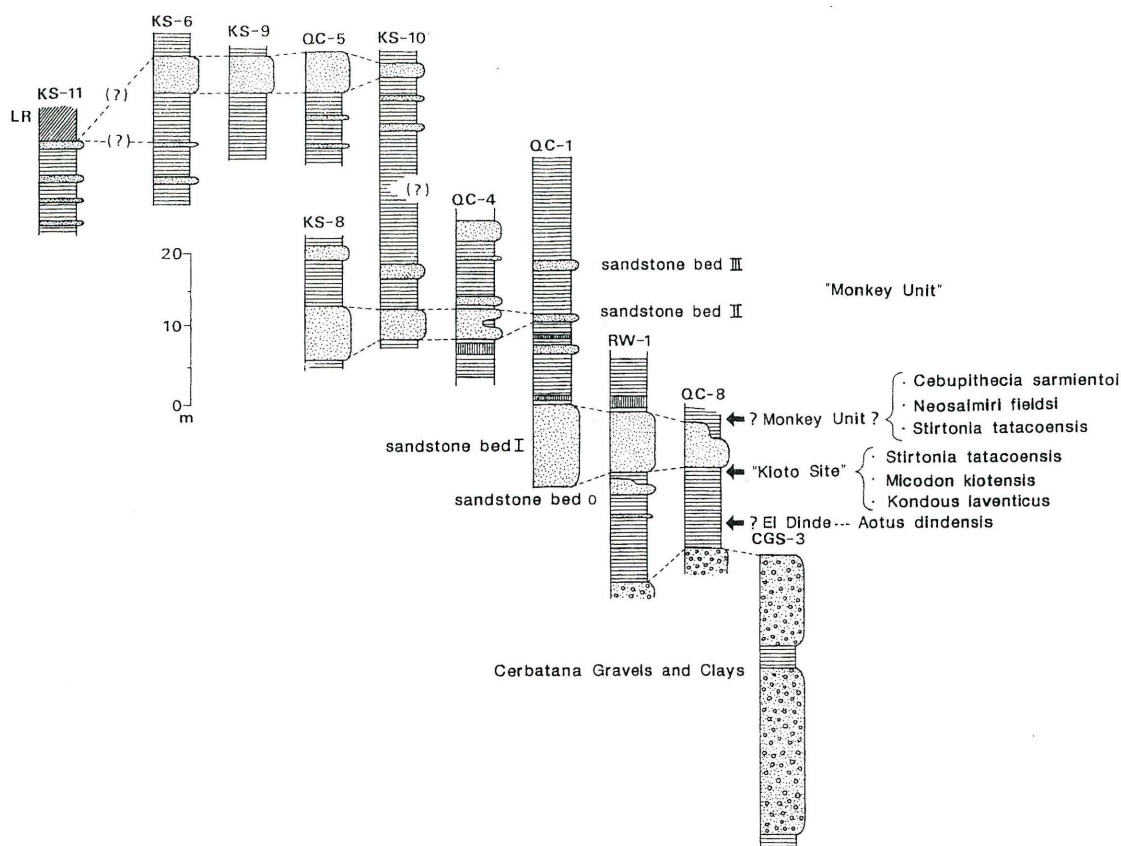


Fig. 3. Columnar sections (see also Figs. 2 and 4)

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LEGEND

- Mesa Conglomerate
- Las Meslitas Sands and Clays
- Upper Red Bed
- Unit Between Upper and Lower Red Beds
- Lower Red Bed
- "Monkey Unit"
- Cerbatana Gravels and Clays
- cotton fields etc.

Map Labels:

- road
- El Dinde
- CGS-3
- QC-8
- QC-1
- QC-4
- KS-10
- KS-8
- KS-6
- KS-9
- La Venta
- Q. La Venta
- KS-11
- LM-6
- LM-5
- Cz-20
- Cz-9
- Cz-8
- Cz-7
- El Cusco
- Q. Cerbatana
- RW-1
- 400

Scale: 1 km